Preliminary Validation
TOPAZ - Gulf of Mexico

(Nuts and Bolts)

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HYCOM NOPP GODAE Meeting

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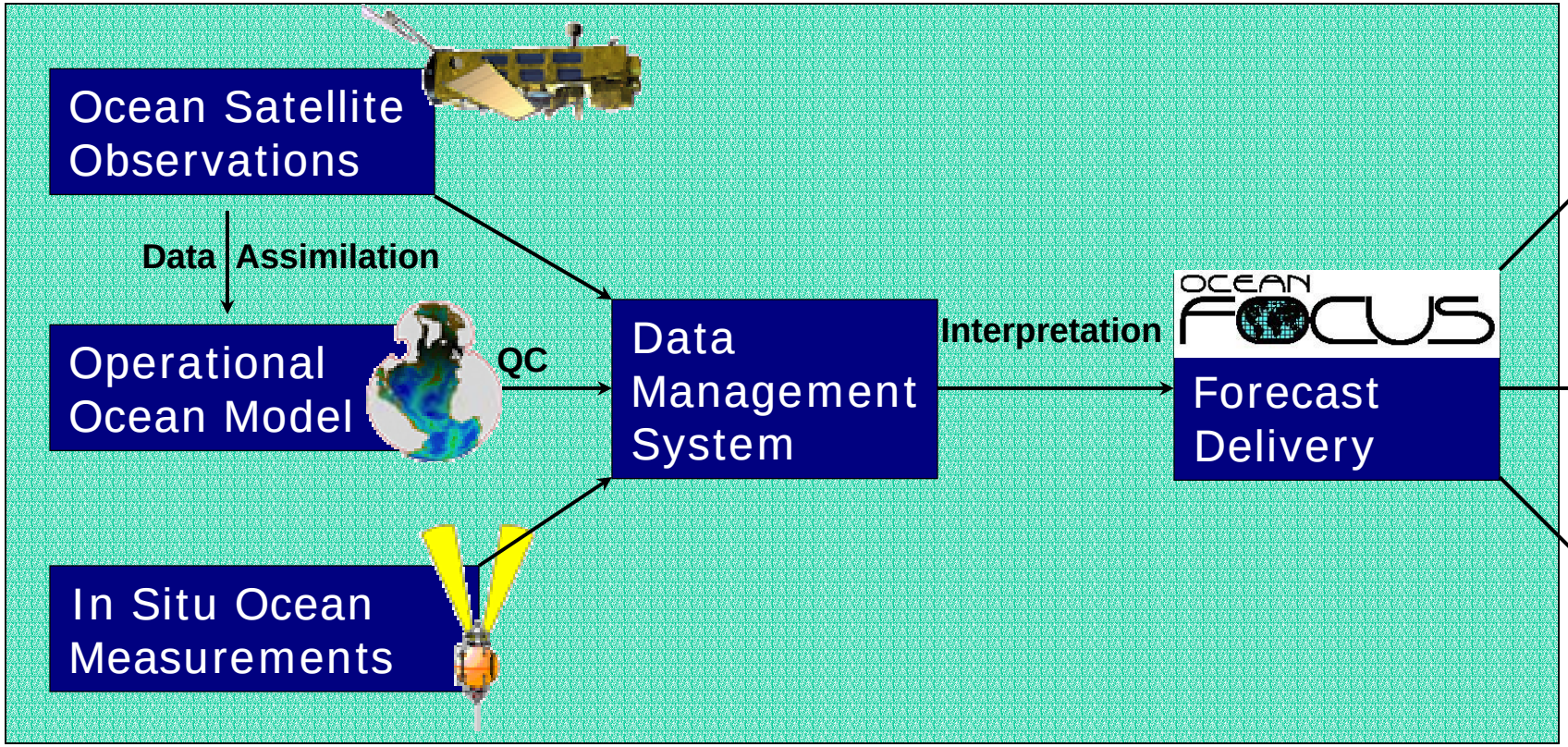
Ocean FOCUS

Ocean FOCUS is a current advisory service using primarily satellite charts and the TOPAZ current forecast model

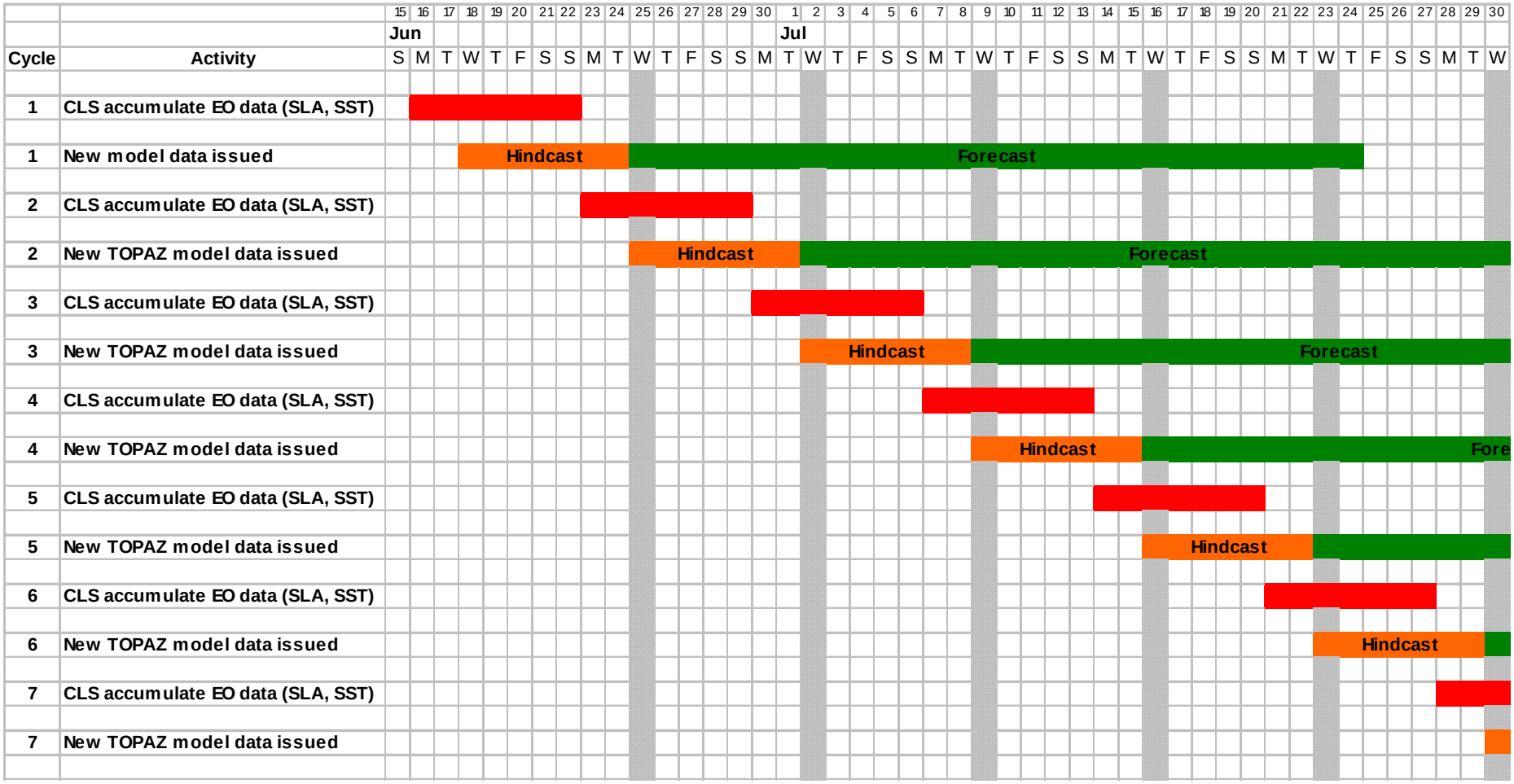
This is a service developed by the Ocean Numerics which is jointly owned by these three companies.

‘Operational Routine’

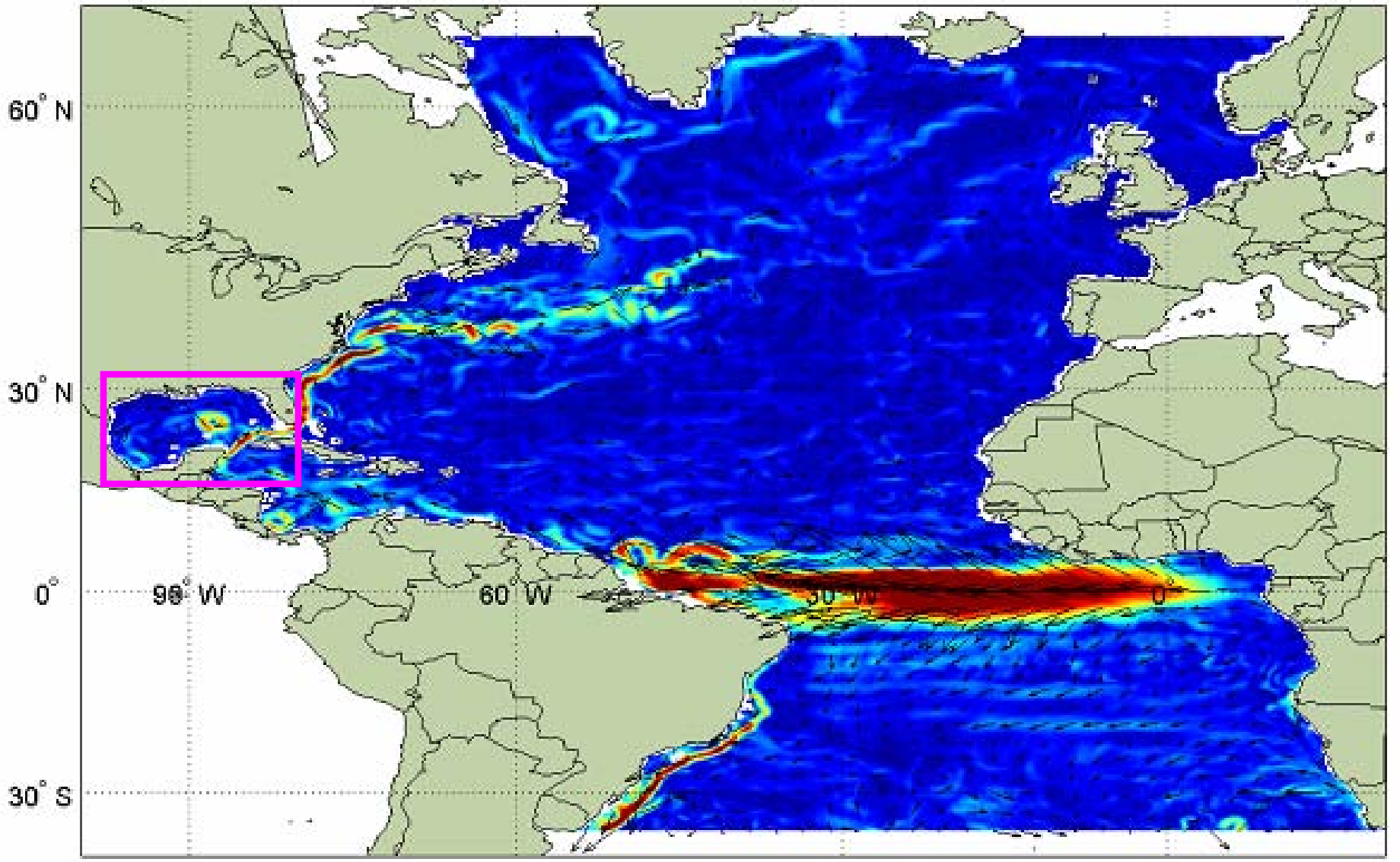


Ocean information to support operational decision-making by the oil and gas industry.

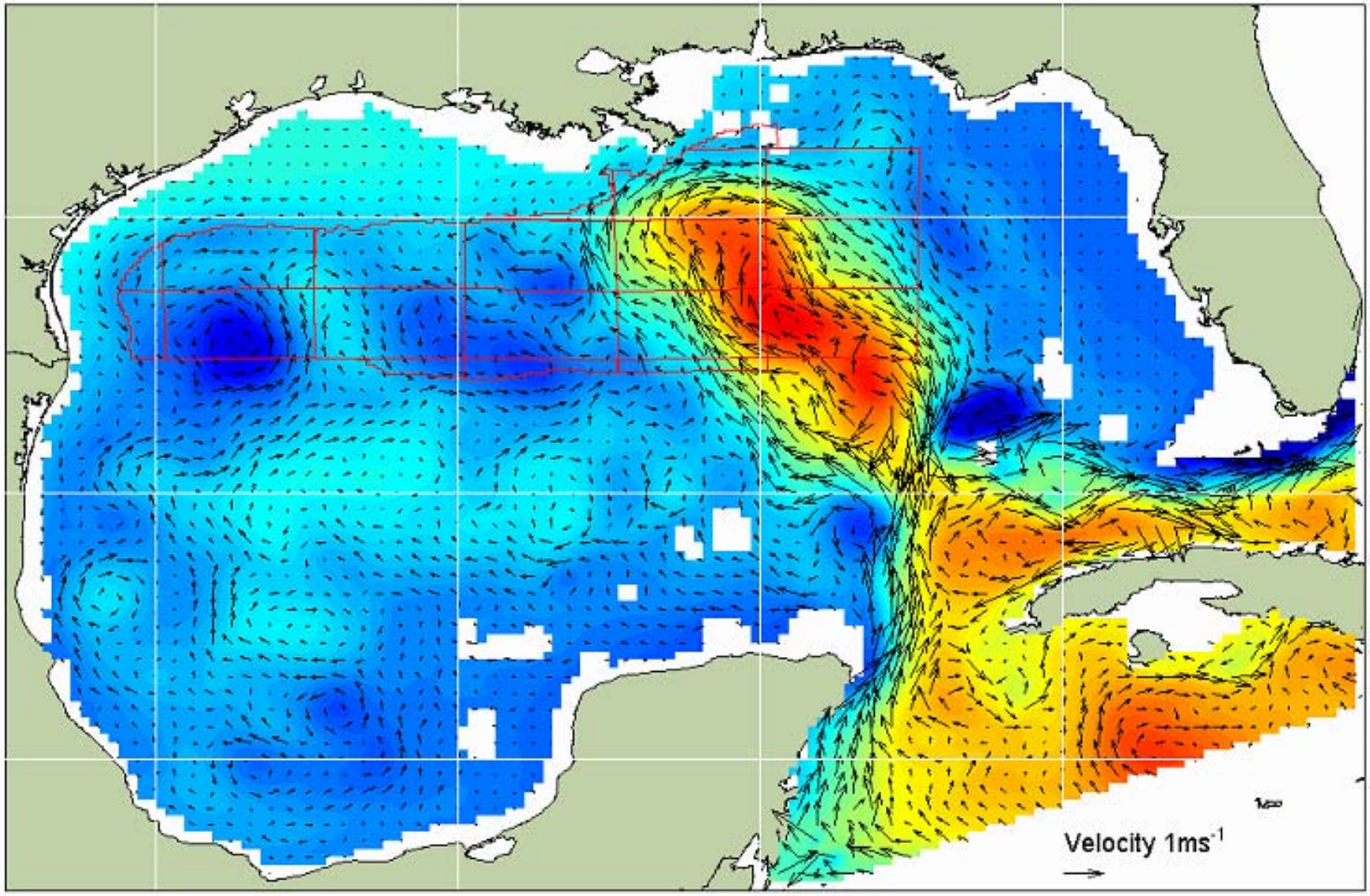
Operational Forecasting Cycle



Nested Regional Model



Forecast Velocity Field



How we would use model validation

- Demonstrate expected accuracy to client - what they can and can't expect

- Use as an aid in continued system development and improvement - continued validation.

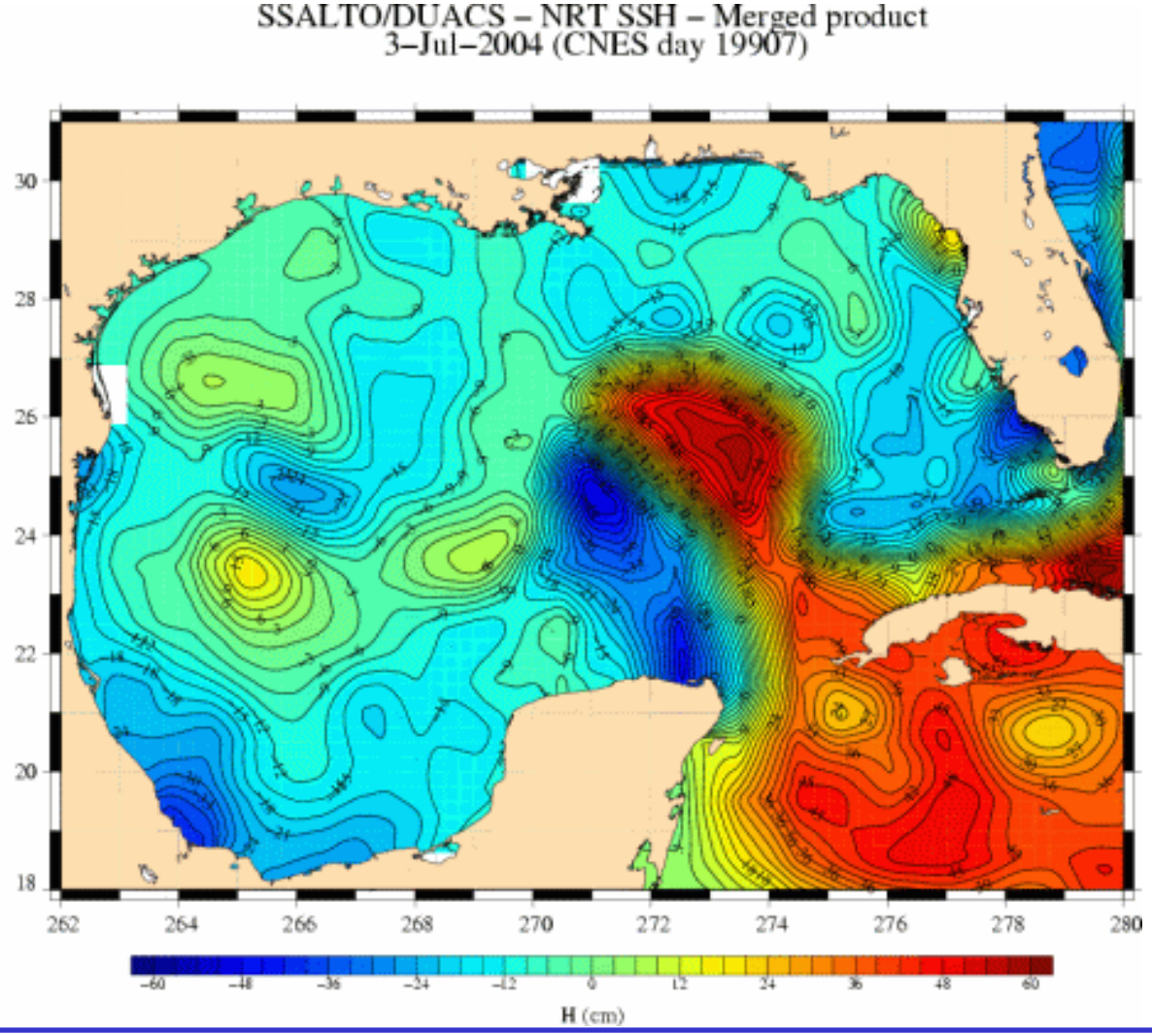
- To answer questions like: How soon will the ring break off the Loop Current? How long will it take the front to reach my location? How long will the strong currents last?

Validation - Demonstration of Skill

- This is the big story for us
- Industry clients need to be convinced that the model results can be useful
- Development by an international consortium and backing of the US Navy has merit but is secondary

Present Status

- We will complete a four month Free Service Trial this week
- Therefore we need to perform an initial validation as soon as possible
- We have started but have a long way to go


SSALTO/DUACS – NRT SSH – Merged product
3–Jul–2004 (CNES day 19907)
30
28
26
24
22
20
18
262
264
266
268
270
272
274
276
278
280
−60
−48
−36
−24
−12
0
12
24
36
48
60
H (cm)

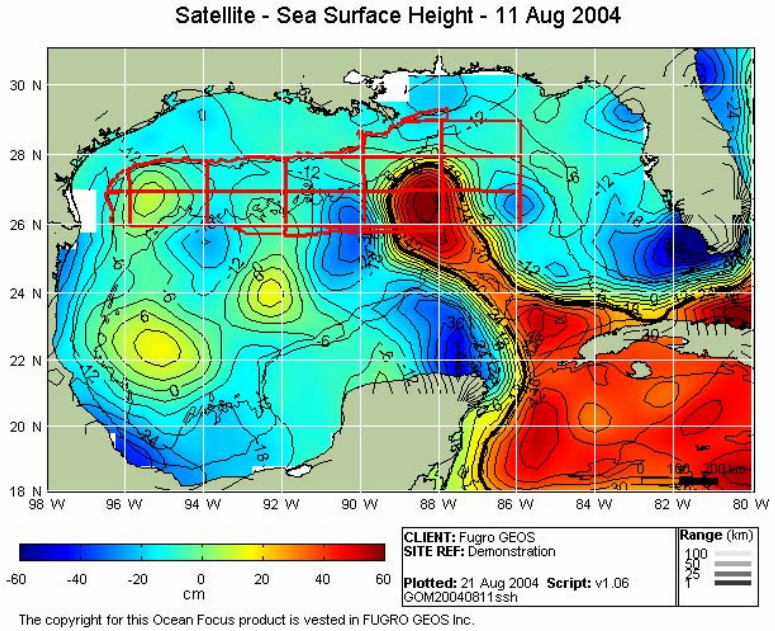
Some Validation Methods

- Visual comparison of SSH fields from model and satellites
- RMS SSH differences through forecast
- Overlay SSH contours on ocean ‘color’
- Parametric fits to features - ellipse fit to Rings
- Tables of occurrence of Loop Current / Rings
- Time series of measured and modeled current

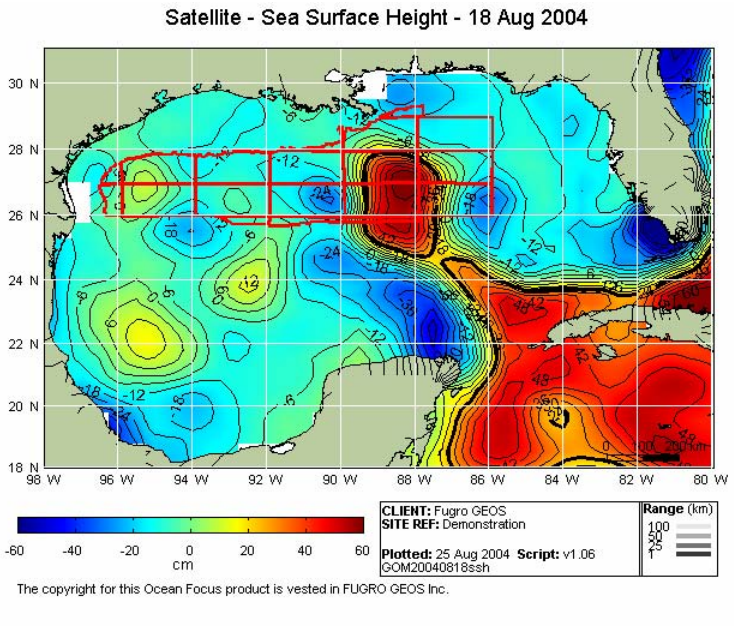
Visual comparison of SSH fields from model and satellites

- Very qualitative

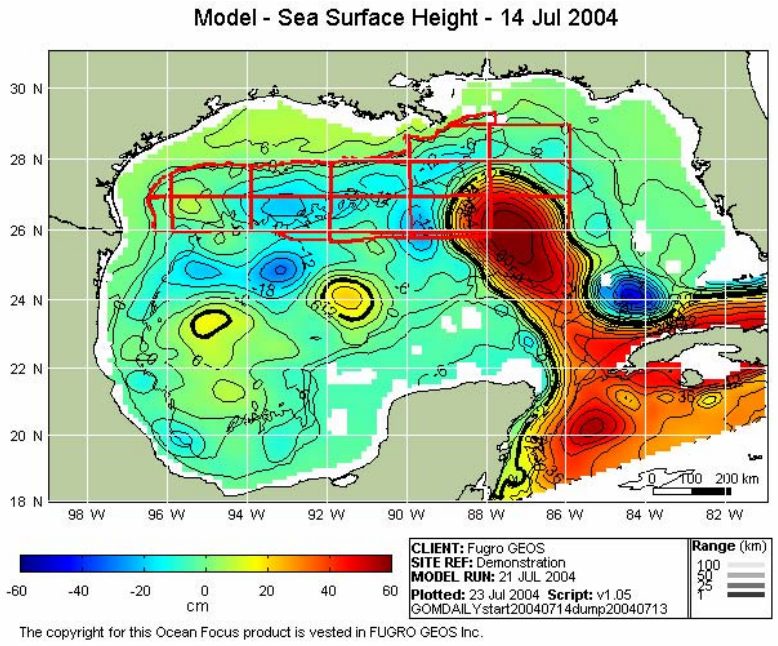
Satellite 11 Aug 04

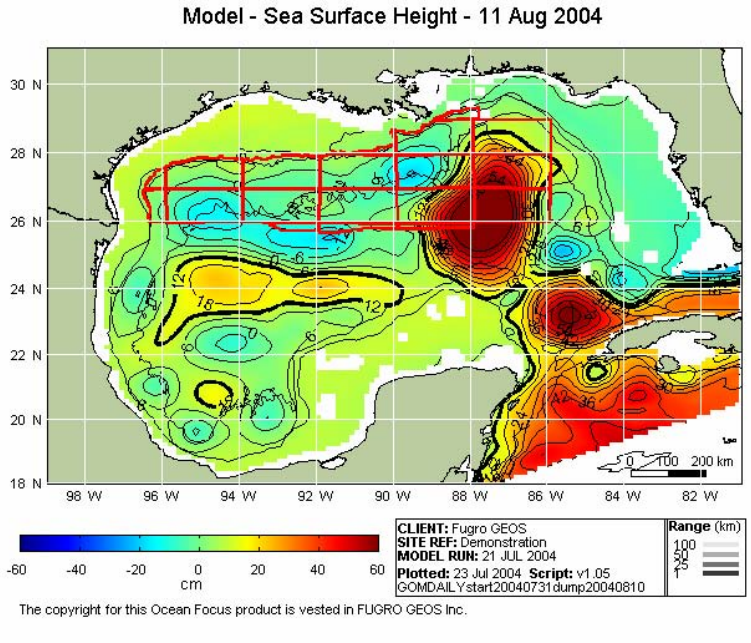


Satellite 18 Aug 04



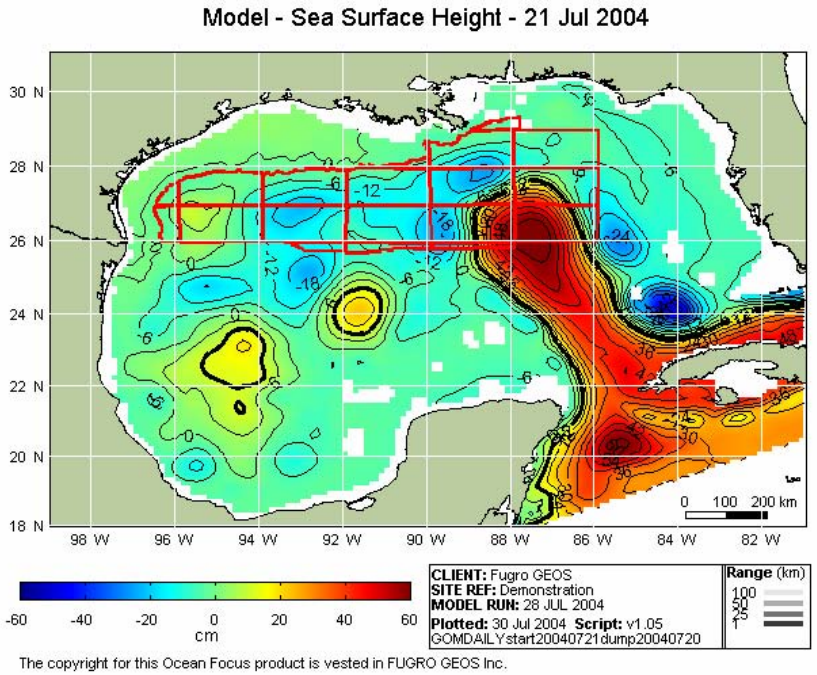
Analysis 14 Jul 04 **(4 week)** **Forecast 11 Aug 04**

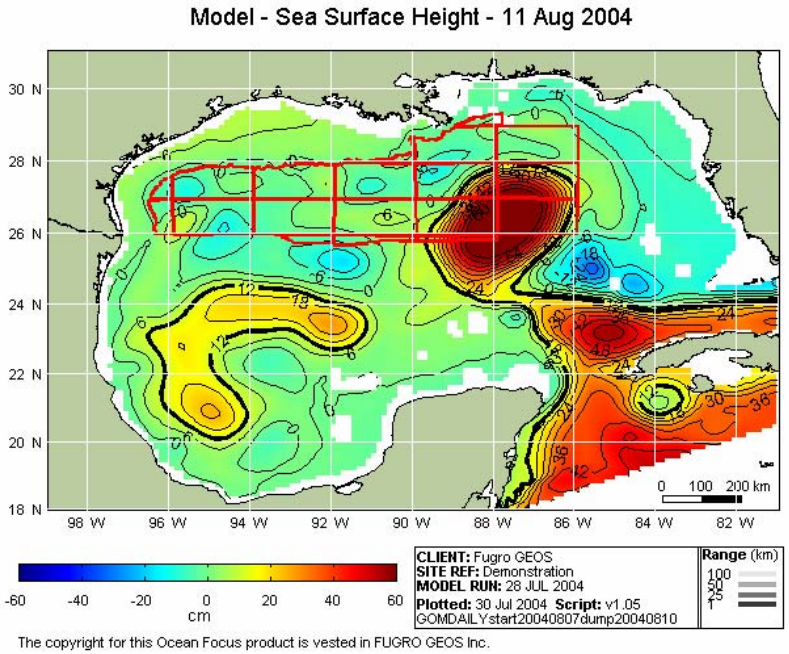




Analysis 21 Jul 04 **(3 week)** **Forecast 11 Aug 04**

Ocean Numerics

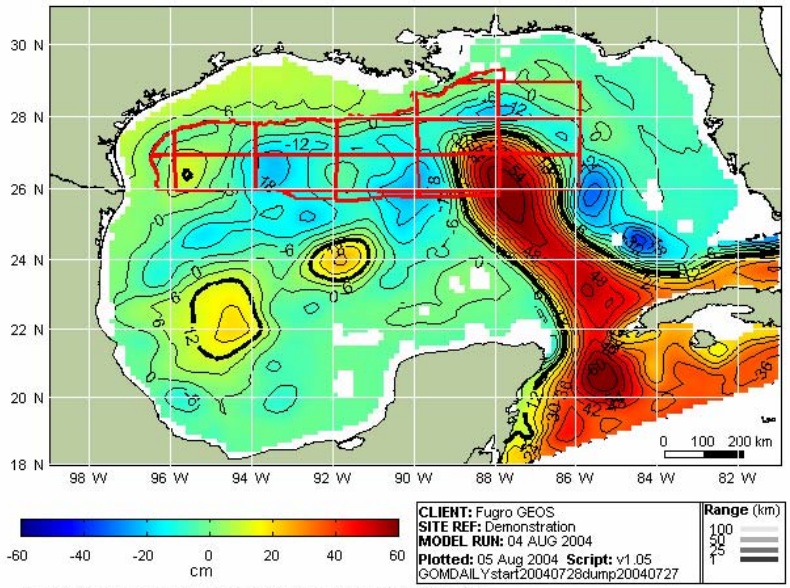




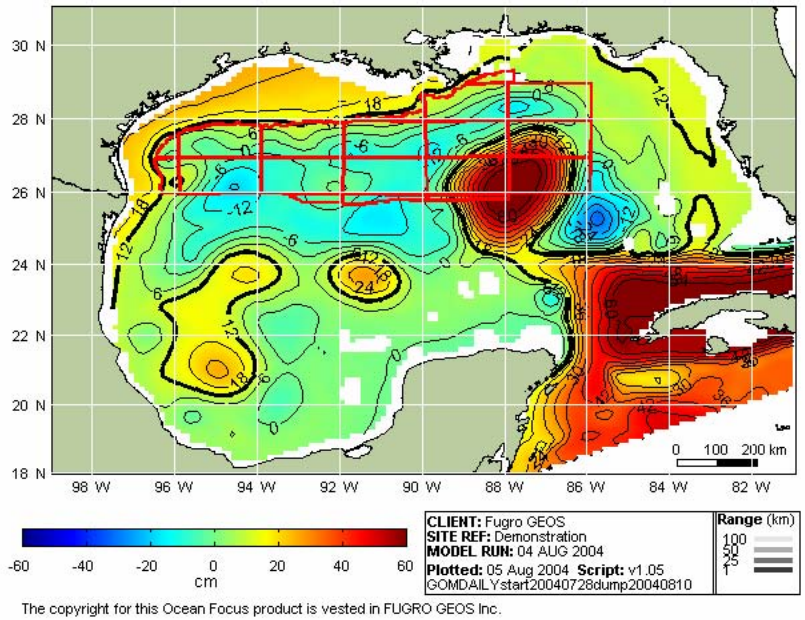
Analysis 28 Jul 04 (2 week) Forecast 11 Aug 04

Ocean Numerics

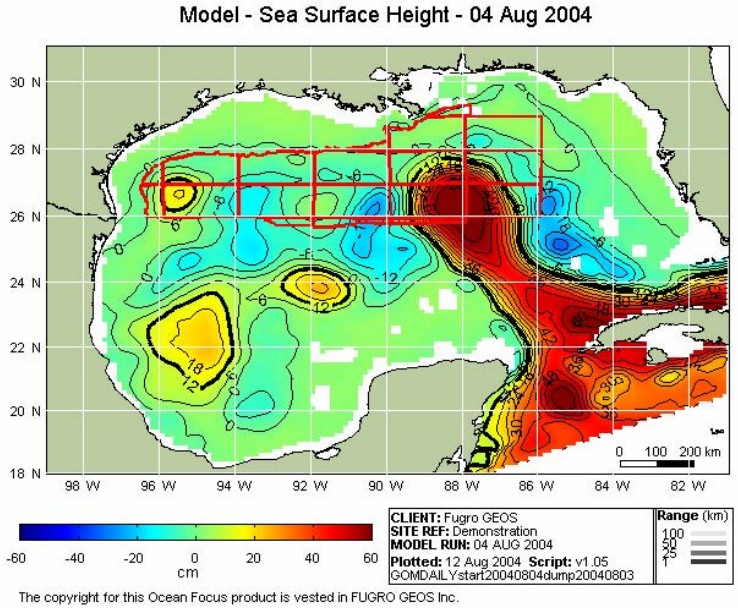
Model - Sea Surface Height - 28 Jul 2004

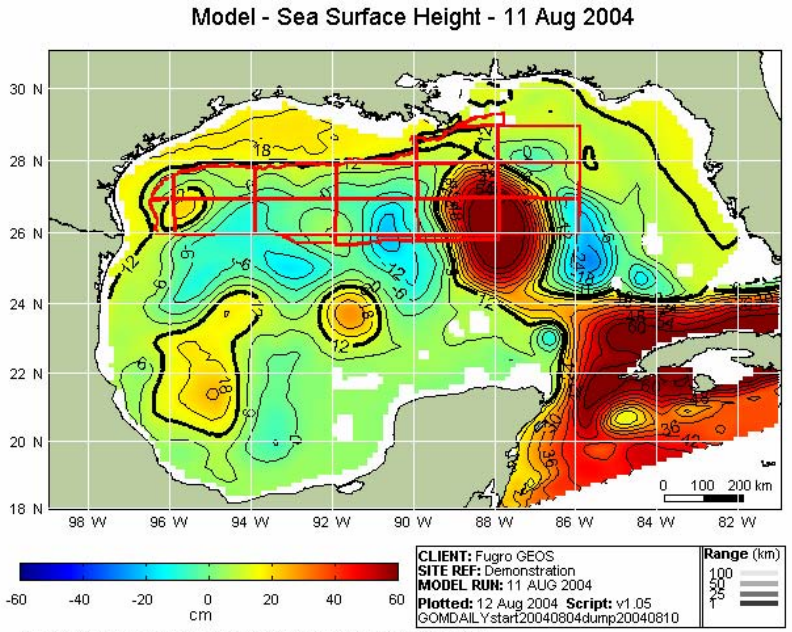


Model - Sea Surface Height - 11 Aug 2004



Analysis 04 Aug 04 (1 week) Forecast 11 Aug 04

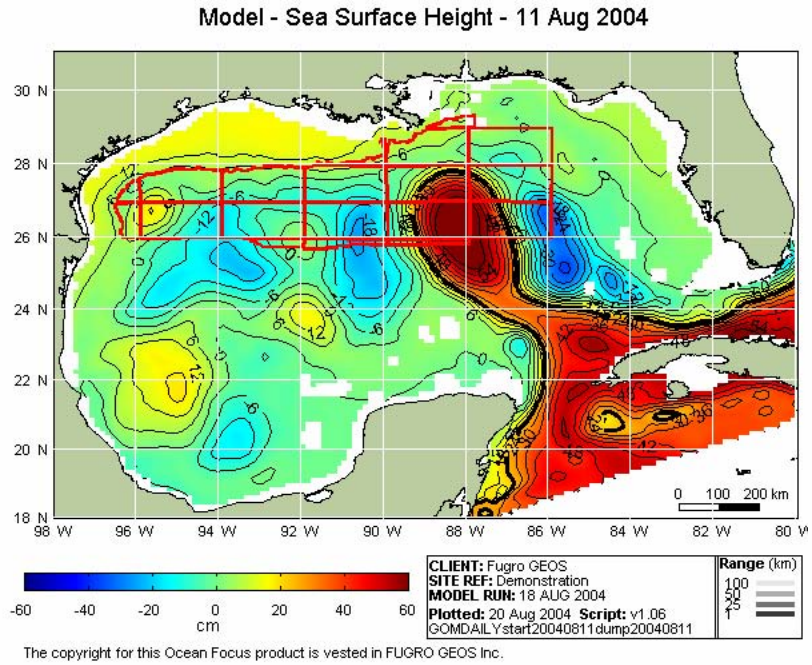


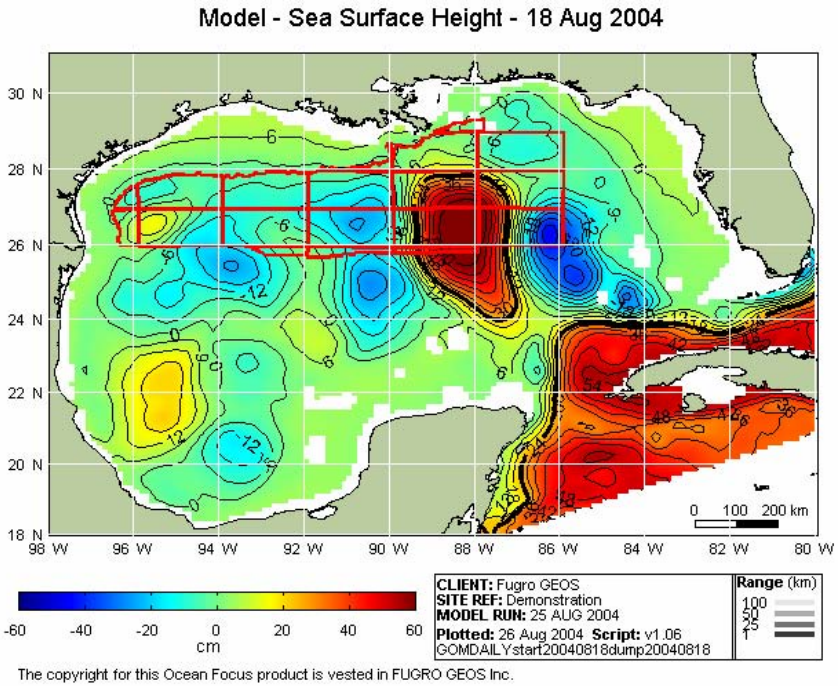


Analysis 11 Aug 04

Analysis 18 Aug 04

Ocean Numerics

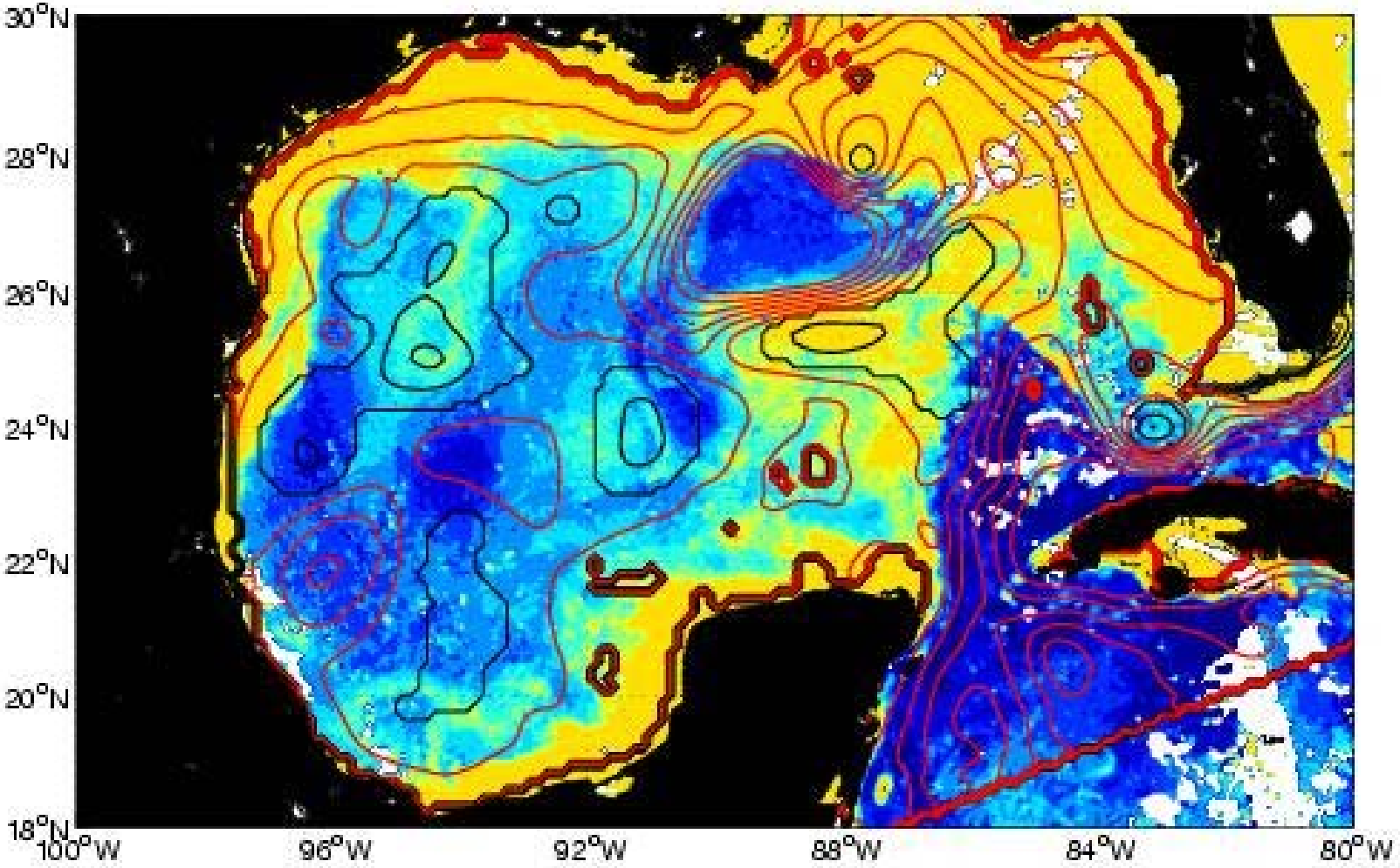




Overlay of SSH Contours on Ocean Color

- Phytoplankton acts as tracer
- High concentration in coastal water
- Low concentration in rings
- Qualitative

Overlay of SSH contours on ocean color



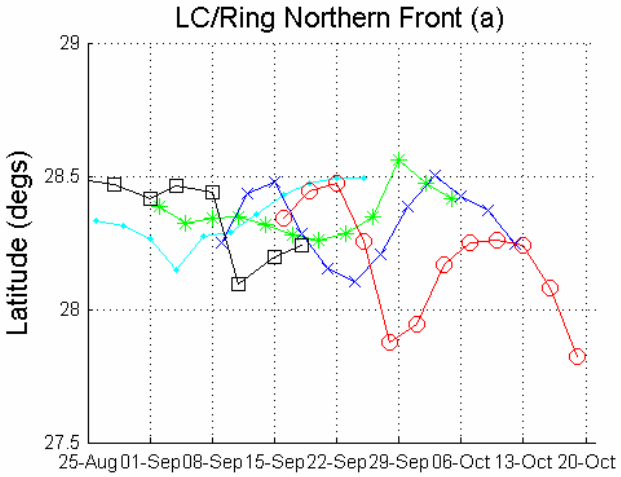
Parametric fits to features - ellipse fit to rings

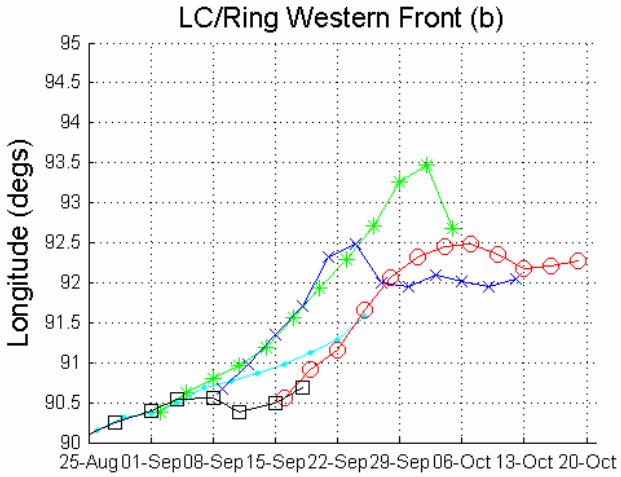
- Parameters:
  - edge location
  - lengths of principal axes
  - orientation of axes
  - ring area
  - speed of rotation
  - speed and direction of translation

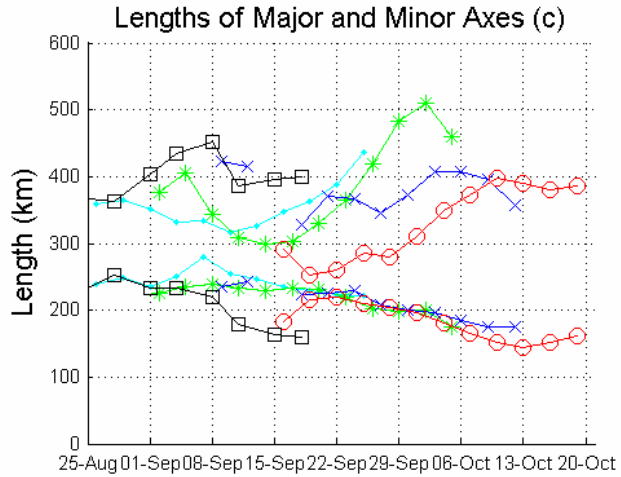
Parametric fits to features - ellipse fit to rings

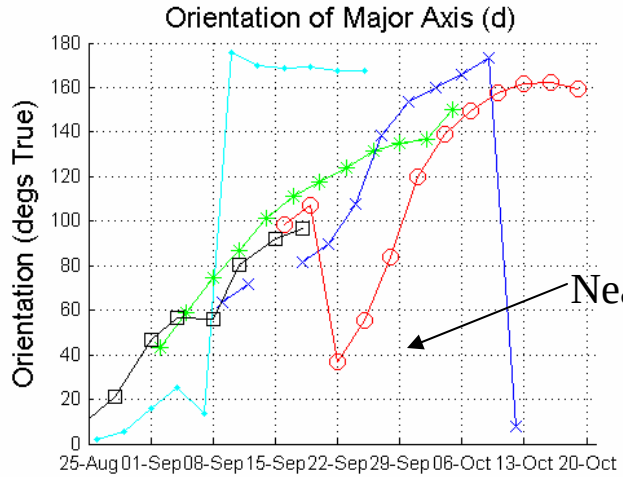
- Difficulties:
  - sensitive to choice of bounding contour
  - if contour too low may go outside of ring
  - if contour too high lose portions of ring
  - model and satellite charts have different mean sea levels (at present)
  - Hurricane Ivan created a large SSH signal
  - rings are not always well described as ellipses

Ellipse Parameters



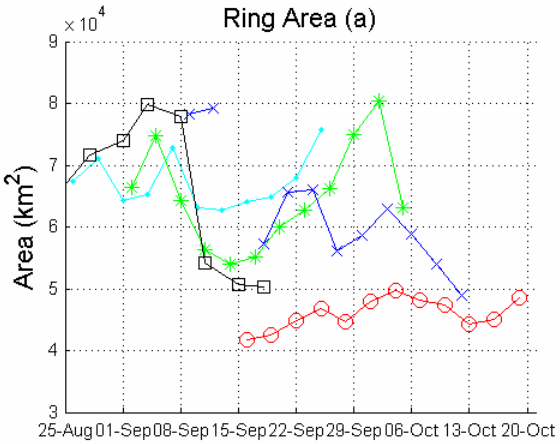


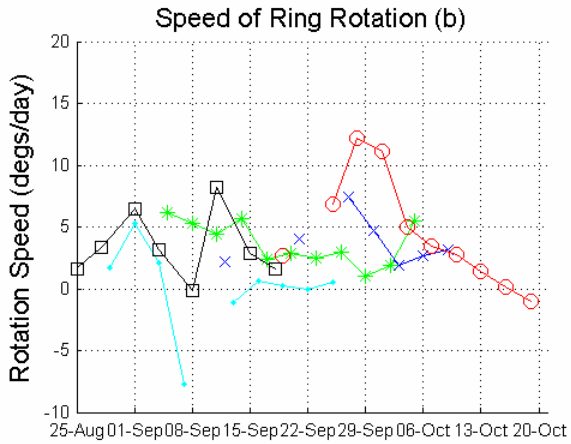


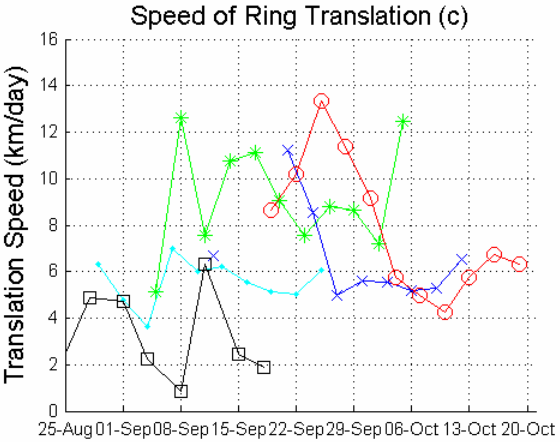


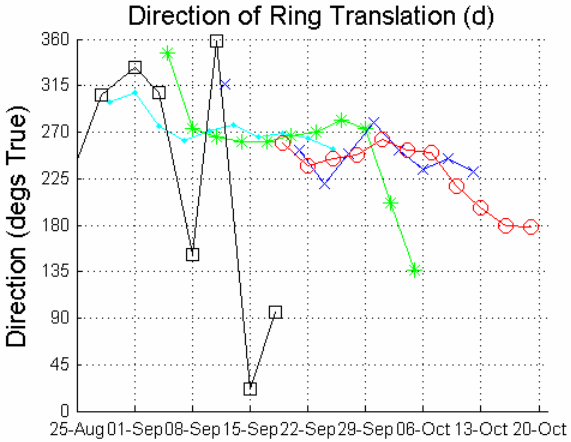
Near circular ring

Ellipse Parameters



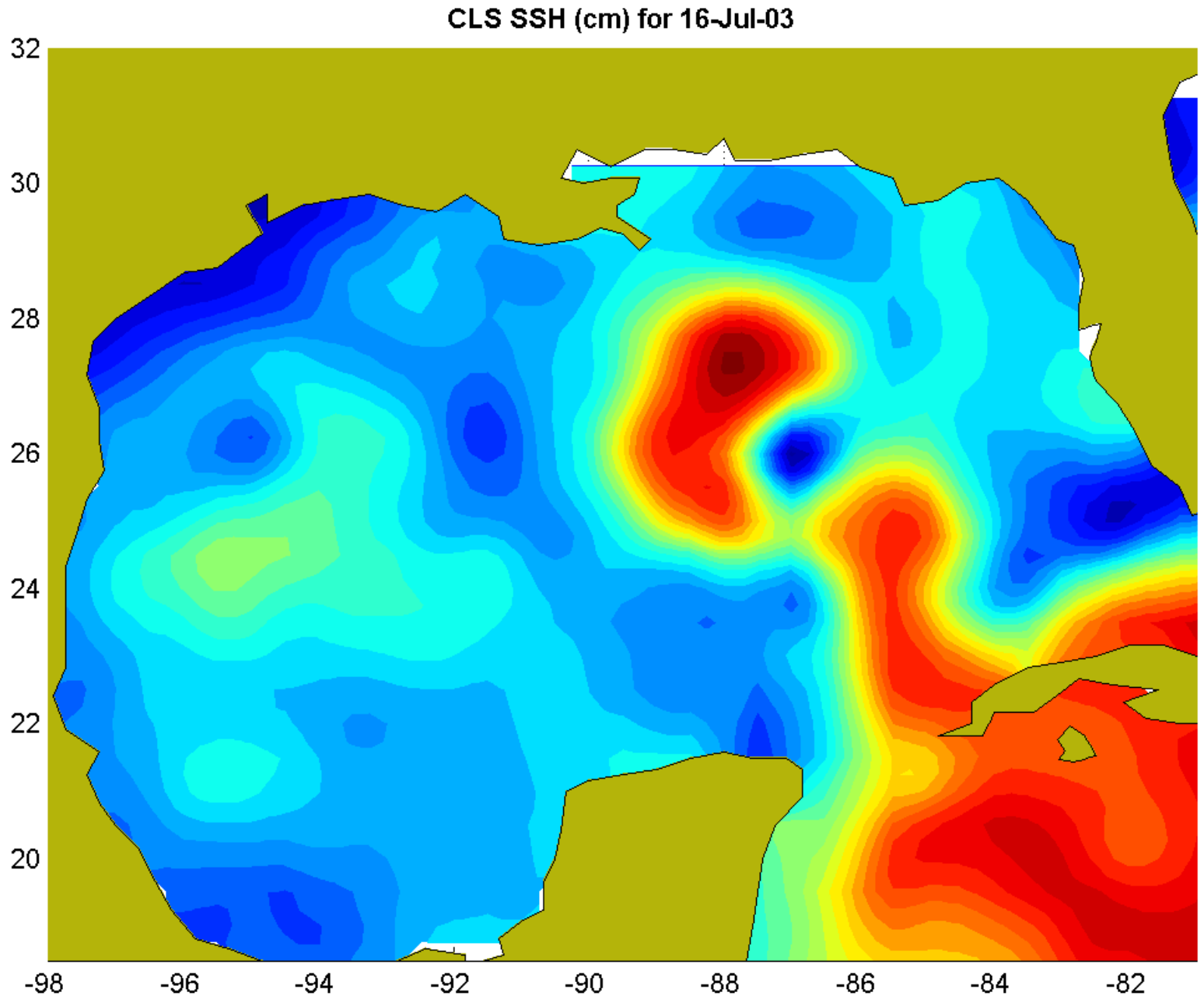


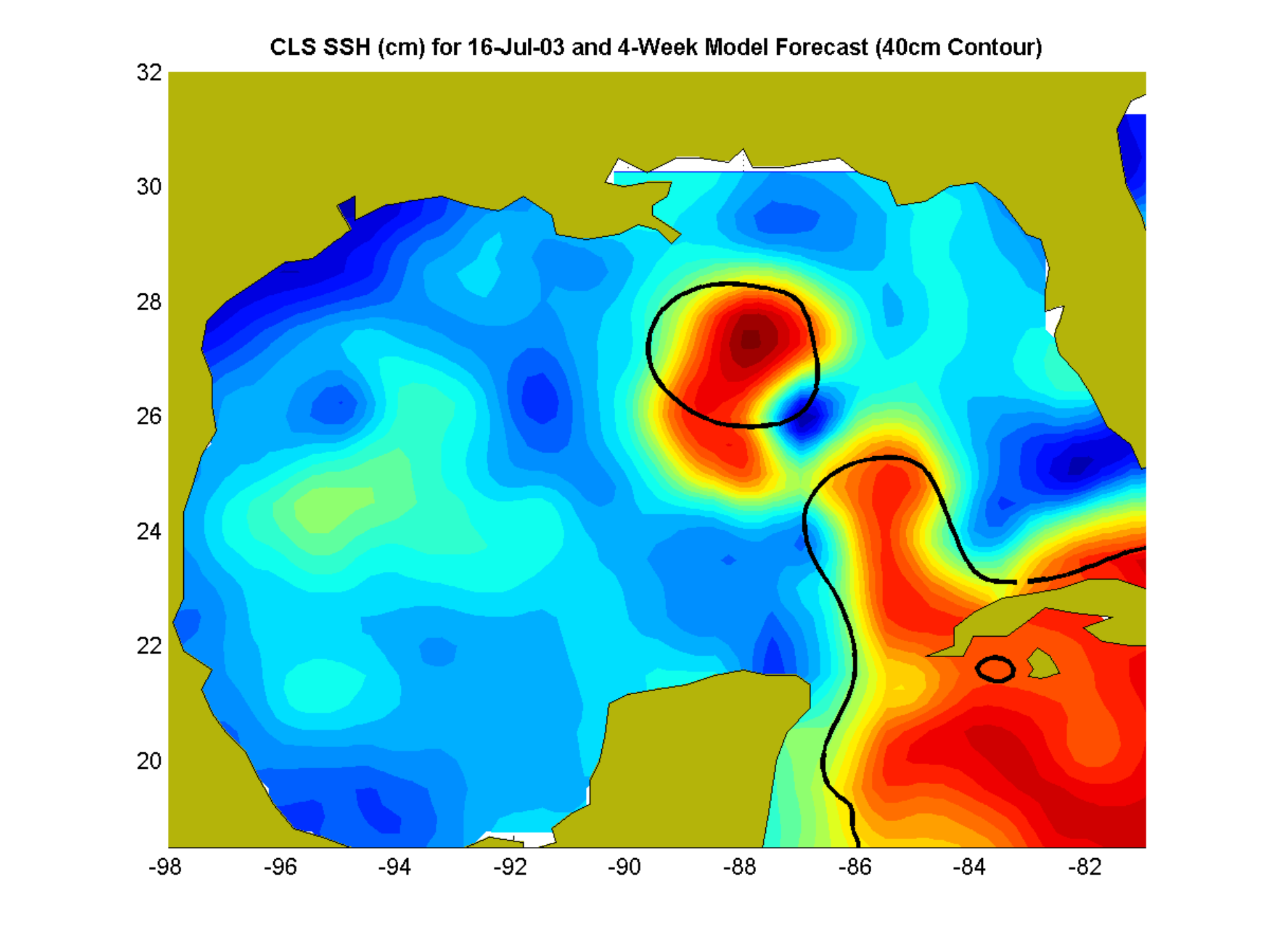


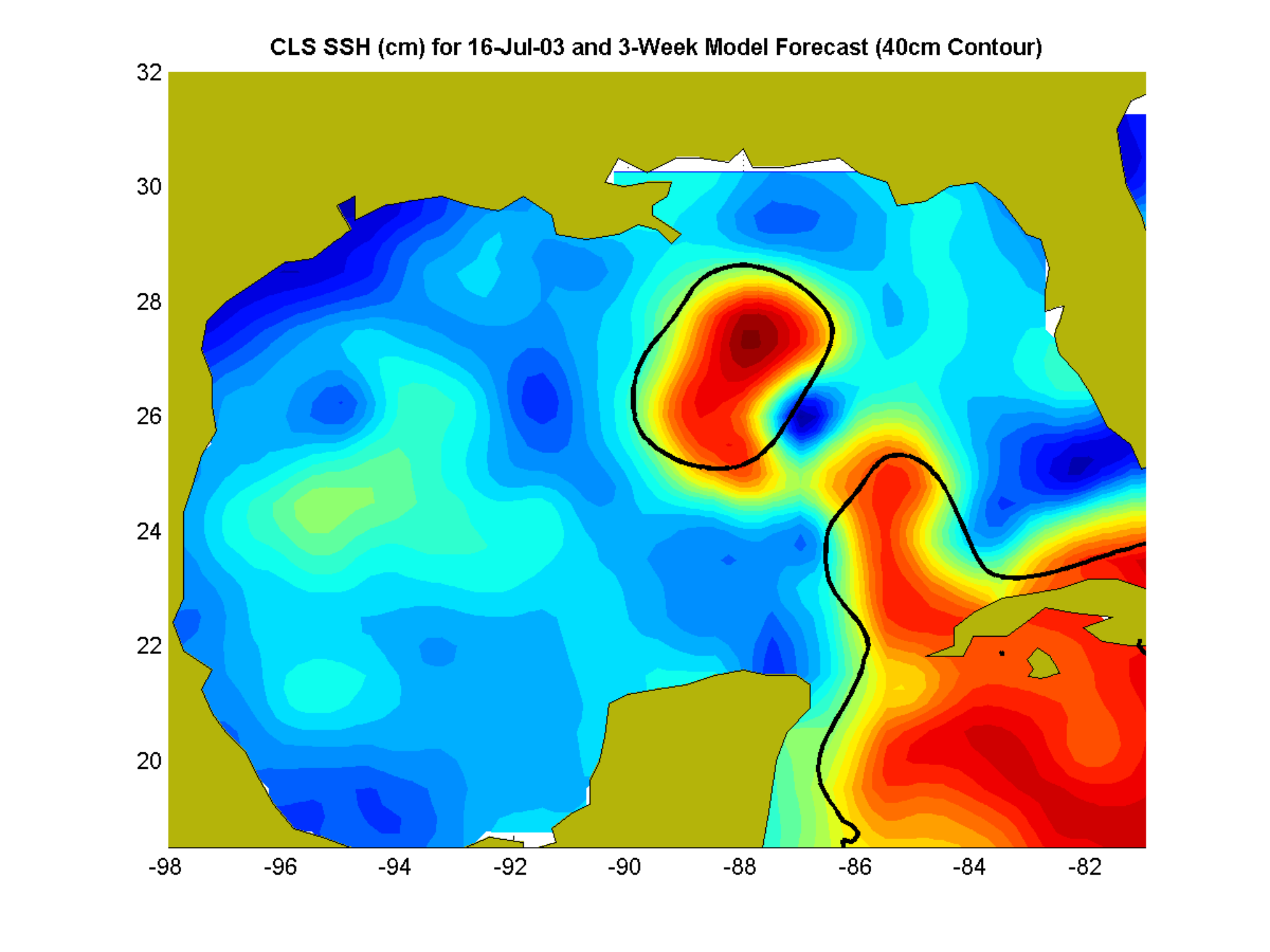


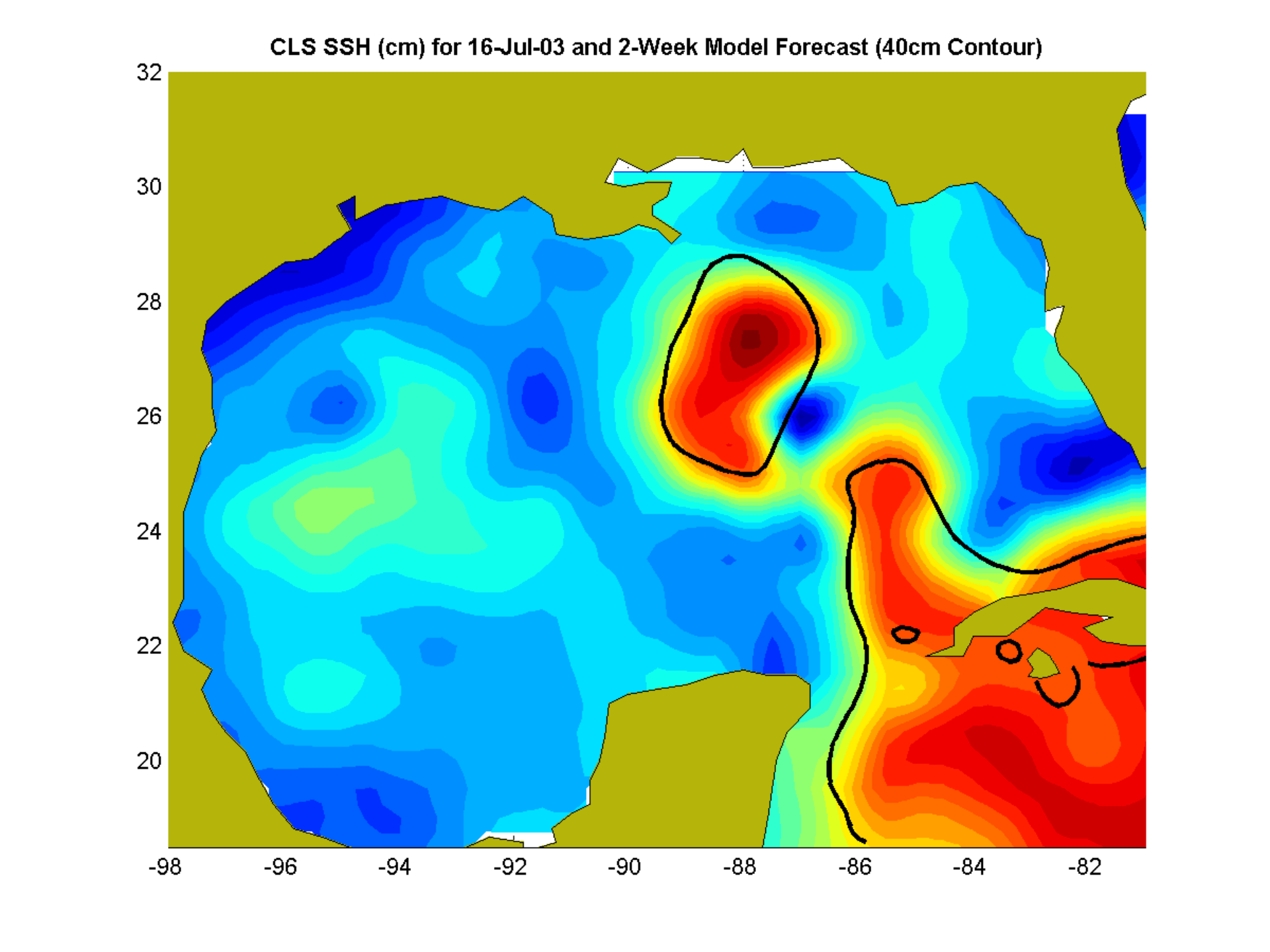
Following sequence

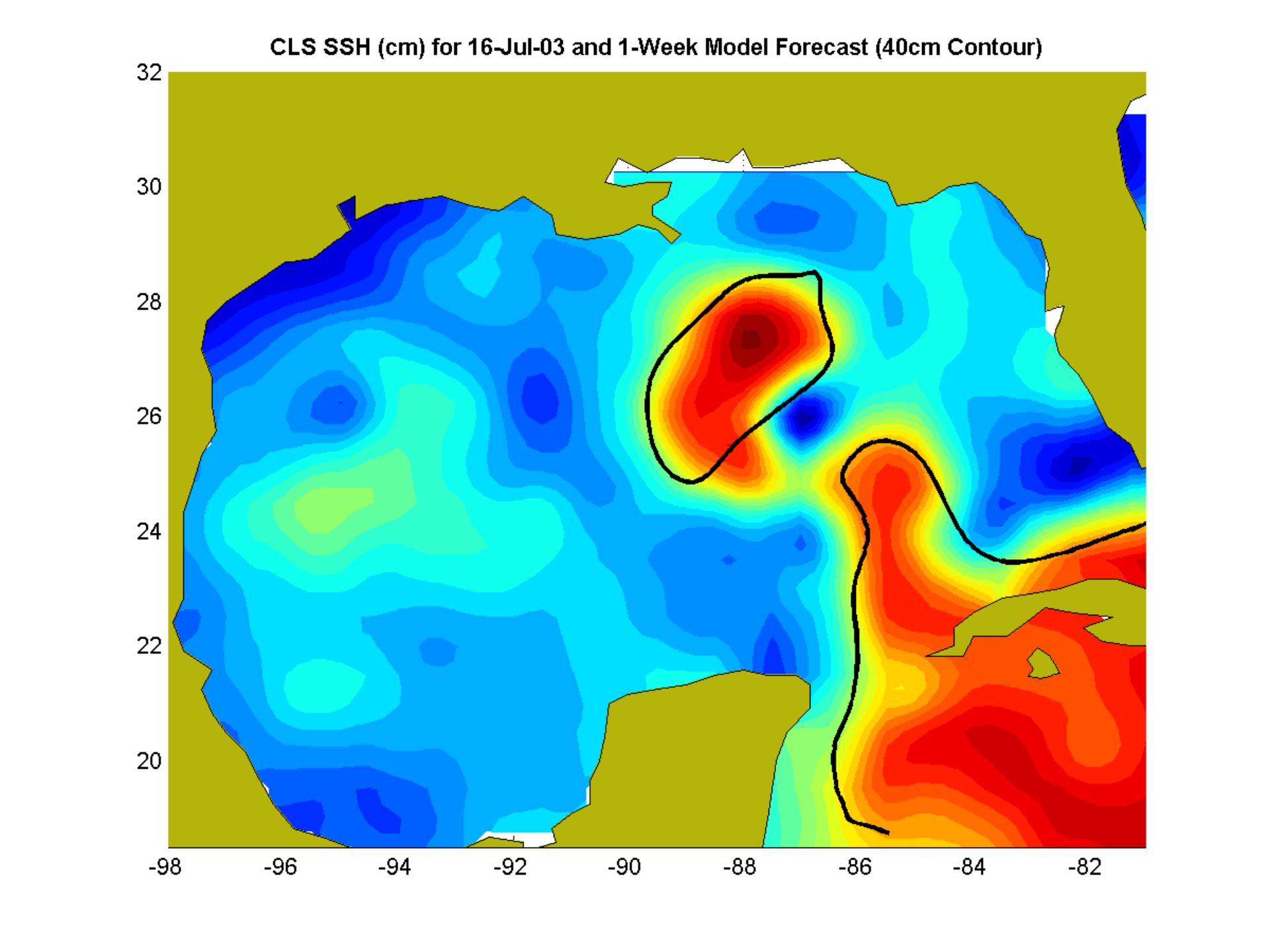
- Satellite SSH chart for 16 July 03
- Contour of 40cm from model at successive forecast times

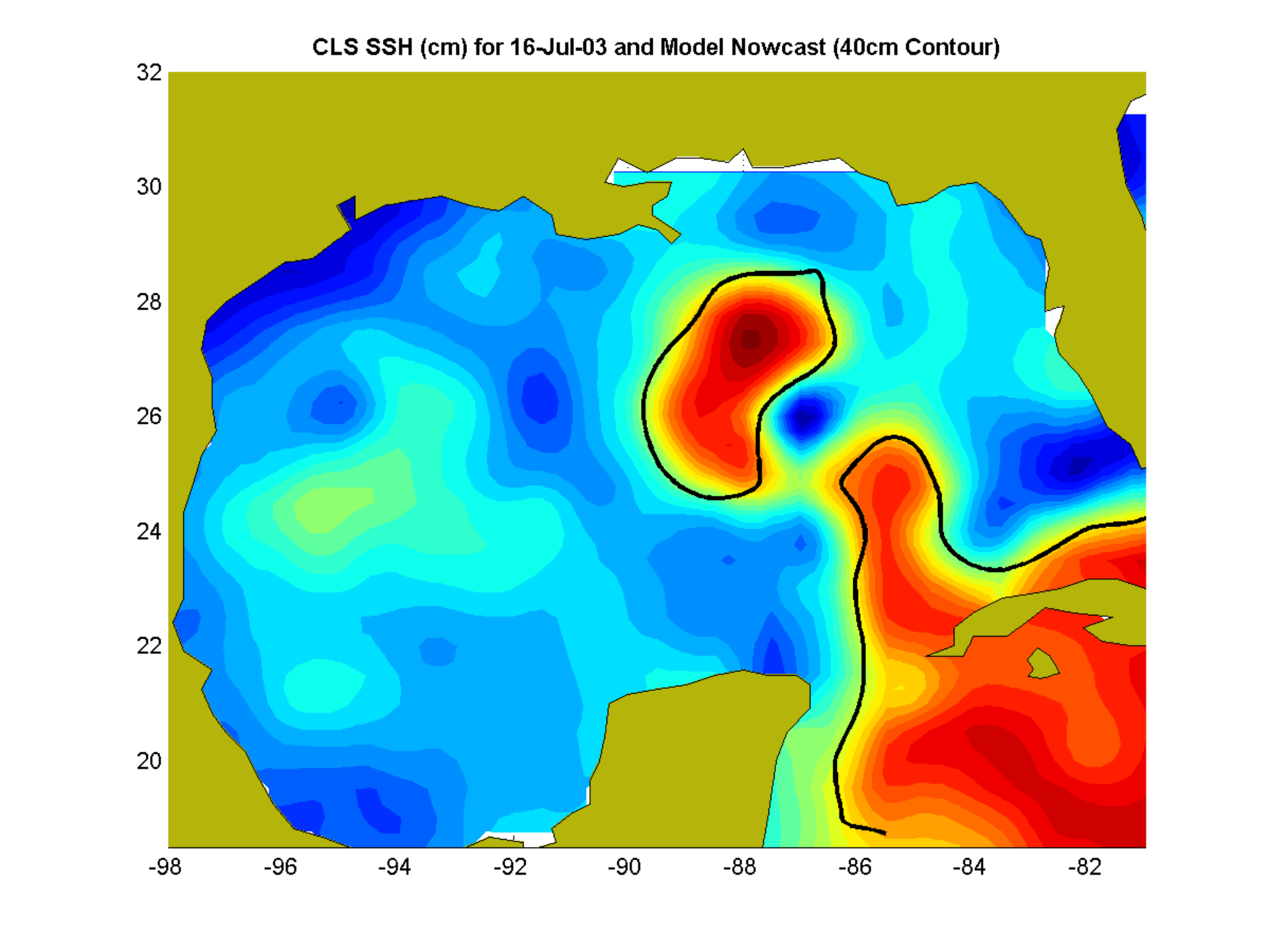

CLS SSH (cm) for 16-Jul-03
32
30
28
26
24
22
20
-98
-96
-94
-92
-90
-88
-86
-84
-82


CLS SSH (cm) for 16-Jul-03 and 4-Week Model Forecast (40cm Contour)
32
30
28
26
24
22
20
-98
-96
-94
-92
-90
-88
-86
-84
-82


CLS SSH (cm) for 16-Jul-03 and 3-Week Model Forecast (40cm Contour)
32
30
28
26
24
22
20
-98
-96
-94
-92
-90
-88
-86
-84
-82


CLS SSH (cm) for 16-Jul-03 and 2-Week Model Forecast (40cm Contour)
32
30
28
26
24
22
20
-98
-96
-94
-92
-90
-88
-86
-84
-82

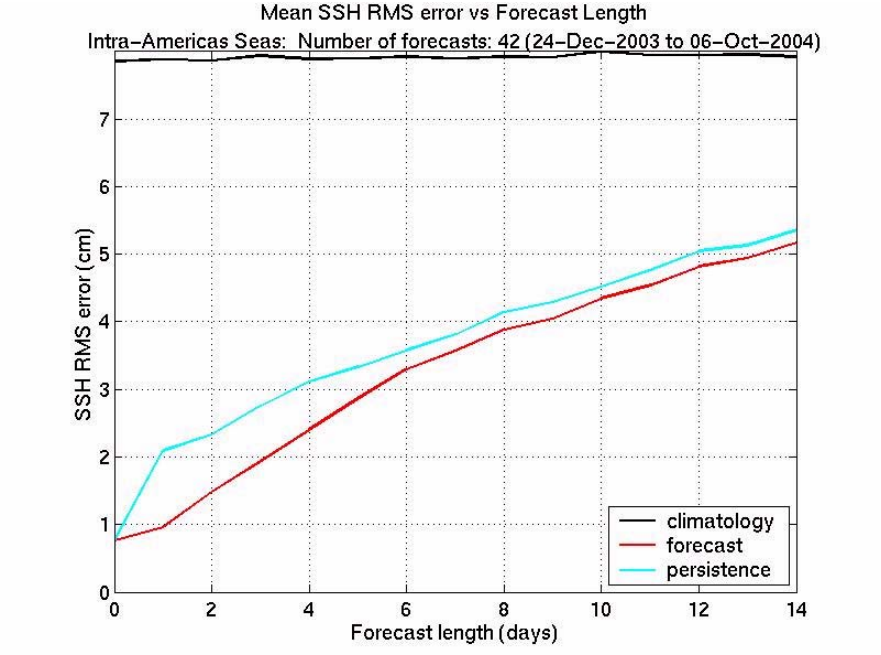

CLS SSH (cm) for 16-Jul-03 and 1-Week Model Forecast (40cm Contour)
32
30
28
26
24
22
20
-98
-96
-94
-92
-90
-88
-86
-84
-82

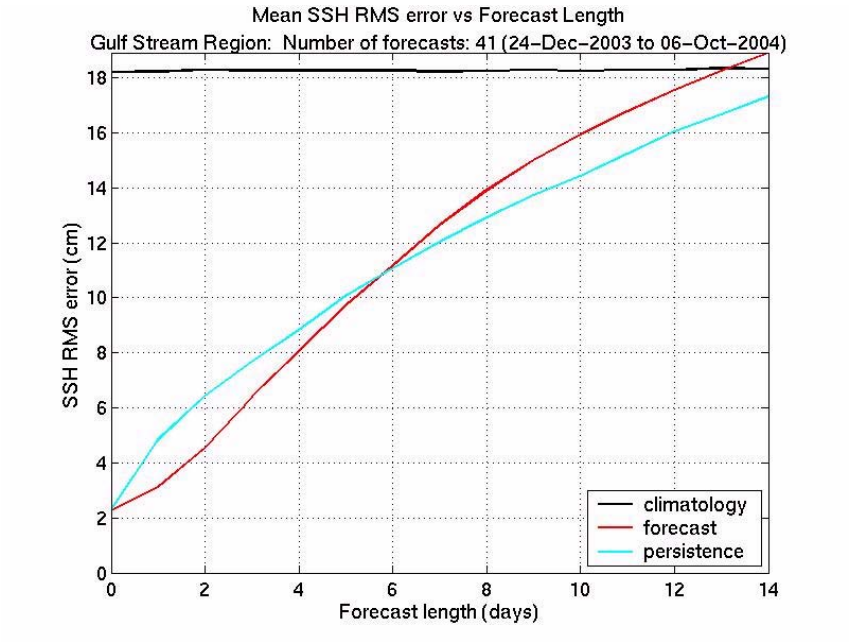

CLS SSH (cm) for 16-Jul-03 and Model Nowcast (40cm Contour)
32
30
28
26
24
22
20
-98
-96
-94
-92
-90
-88
-86
-84
-82

Tables of occurrence of Loop Current / Rings in specific areas by forecast

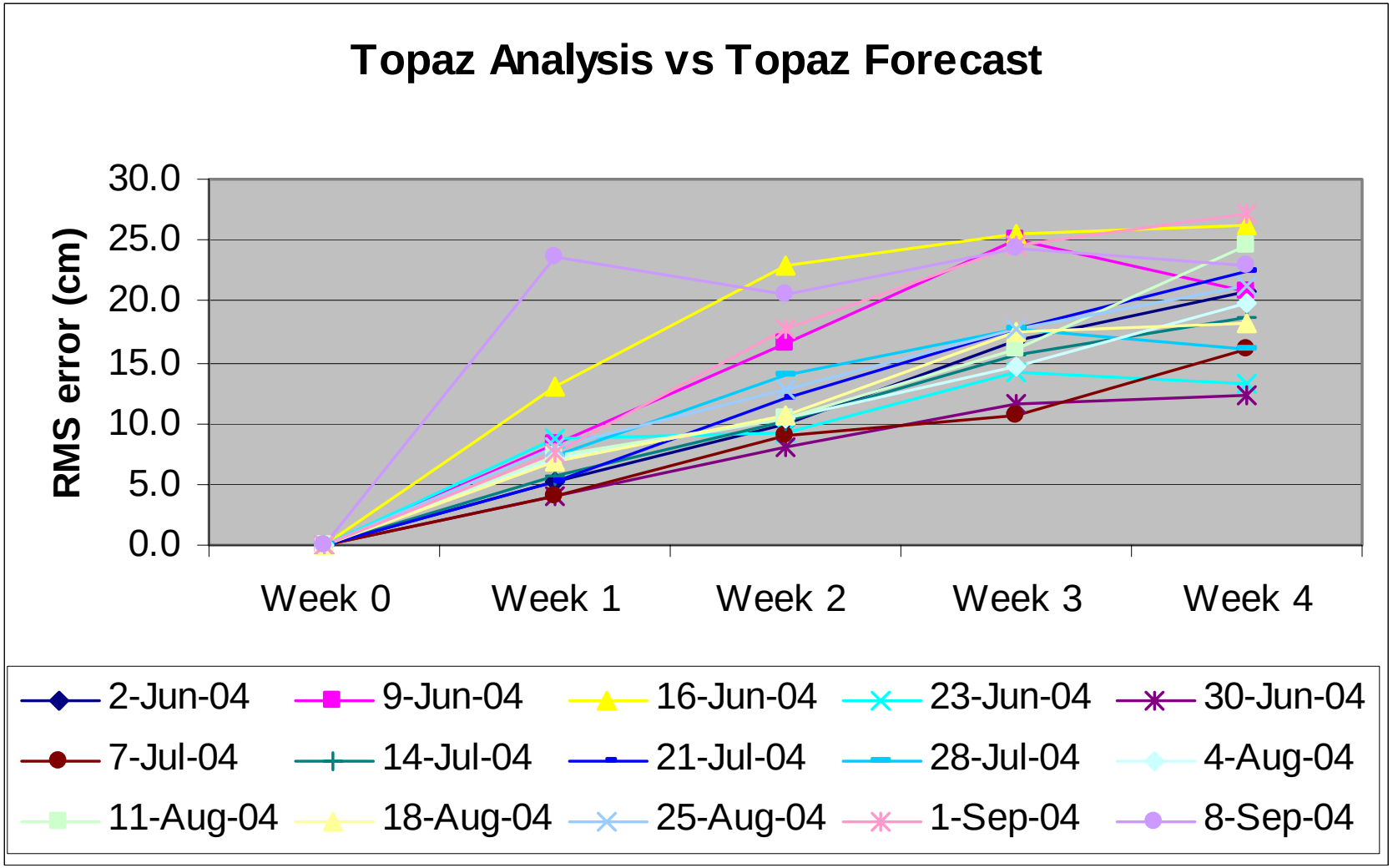
Area	DeSoto Canyon					
	Satellite		Nowcast (NC) + N days			
Date	(truth)	Analysis	NC	NC+7	NC+14	NC+21
7-Jul-04	N	N				
14-Jul-04	N	N	N			
21-Jul-04	N	N	N	N		
28-Jul-04	N	N	N	Y	Y	
4-Aug-04	N	N	N	N	Y	Y
11-Aug-04	N	N	SW	N	Y	Y
18-Aug-04	SW	SWC	N	SW	SW	N
25-Aug-04	SW	SWC	SWC	N	N	N
1-Sep-04	Y	Y	SWC	N	N	N
8-Sep-04	Y	SWC	SW	N	N	N
15-Sep-04	N	N	Y	N	N	N
22-Sep-04	N	N	N	N	N	N
29-Sep-04	N	N	N	N	N	N
6-Oct-04	N	N	N	N	N	N

Mean SSH RMS Error vs Forecast Length





Mean RMS SSH Error by Forecast



Mean SSH RMS Error vs Forecast Length

- What is used for truth - satellite or model?
- This is dependent on regional energy
- Is it dependent on grid resolution?